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ABSTRACT

This monograph describes how special educators in seven schools are using technology to promote literacy. Profiles of the different schools provide concrete examples of technology use in different instructional settings and demonstrate how various educational philosophies and implementation efforts help schools build successful technology-based instructional practices. The examples include schools that are using technology to: (1) include students with disabilities in general education classrooms; (2) motivate and teach skills to students with severe emotional disturbances and conduct disorder who are in an alternative program; (3) teach literacy to students with moderate and severe cognitive and physical disabilities; (4) identify needs and delivery services to children with visual impairments; (5) provide mobile needs assessment, training, and technical assistance to preschool children with disabilities; (6) support mainstreaming and skill development of children with hearing impairments; and (7) build communication and independent living skills in children with autism. In each of the case studies, information is provided on how technology is being integrated into the curriculum. The case studies demonstrate that technology does not have to be complex or expensive to be successful. A resource list is included that provides contact information for relevant technology companies. (CR)

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Technology Links to Literacy

to promote literacy

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Technology Links to Literacy

A case book of special educators' use of technology to promote literacy

Edited by James M. Craver and Lisa Burton-Radzely
Contributing authors: Lisa Burton-Radzely, James M. Craver, Melinda Moyer, and Elaine Pierrel

Macro International Inc.
Calverton, MD

Technology links to literacy: a case book of special educators' use of technology to promote literacy
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Calverton, Maryland
Edited by James M. Craver and Lisa Burton-Radzely
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At Morristown Elementary School, Morrisville, Vermont, Principal Fredericka French and all Apple Classroom of Tomorrow teachers.

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Table of Contents

Introduction 1

Supporting full inclusion 7
Full spectrum of disabilities
Morristown Elementary School, Morrisville, Vermont

Building skills and motivating students 13
Severe emotional disturbance and conduct disorder
Red Bluff Joint Union High School, Red Bluff, California

Establishing early literacy 17
Moderate and severe cognitive and physical disabilities
South Fork High School, Stuart, Florida

Collaborating to identify needs and deliver services 23
Visual impairments
Metro Nashville School District, Nashville, Tennessee

Providing mobile needs assessment, training, and technical assistance 29
Full spectrum of disabilities
Dade County Public Schools, Miami, Florida

Supporting mainstreaming and skill development 33
Hearing impairments
Palm Springs Middle School, Hialeah, Florida

Building communication and independent living skills 37
Autism
Oakland County Intermediate Unit, Madison Heights, Michigan

Resource list 41

Photo descriptions 42

Endnotes 42

Introduction: The challenge of literacy

As our world grows increasingly complex, literacy has become an essential skill. According to a 1997 report by the National Center for Education Statistics (NCES), people with higher literacy levels are more likely to be employed and earn more than those with lower literacy levels.[1] NCES also found that people at the higher end of the continuum of literacy have a broader set of choices open to them.[2] These conclusions do not imply that simply having a high literacy level guarantees a high-paying job, but the data suggest that literacy can be instrumental in expanding opportunities.

Recognizing literacy's importance, the Goals 2000: Educate America Act of 1994 emphasizes literacy education.[3] Goal Three addresses students' competence in subject matter and in reasoning skills. Goal Six addresses literacy and general competence for every adult American. Beyond simple support for literacy, the Goals 2000 effort incorporates the broader perspective of literacy, stating that "every American will be literate and will possess the knowledge and skills necessary to compete in a global economy and experience the rights and responsibilities of citizenry." The U.S. Department of Education, Office of Special Education and Rehabilitative Services (OSERS) makes this goal concrete by supporting projects that operationalize literacy and specifically reading, communicating, computing, making judgements, and taking appropriate action.

Literacy includes more than being able to read and write. Readers know tacitly, teachers know explicitly, and special education researchers demonstrate that literacy requires a broader skill base than letter recognition or word and sentence formation. Literacy requires comprehension, and comprehension requires a foundation of various experiences and skills. Literacy involves not just interpreting language, but also using that interpretation to effectively communicate wishes and intentions in all available media. A complete definition of literacy incorporates the recognition, interpretation, and production of language. It also includes mathematical ability to enable complex thought and symbolic reasoning.

In 1994, OSERS released a Request for Proposals to support "research projects that examine how advancing the availability, quality, use, and effectiveness of technology, educational media, and materials can address the problem of illiteracy among individuals with disabilities." In response, Macro International Inc. (Macro) and the Council for Exceptional Children (CEC) have been engaged in a multidimensional project entitled A National Perspective on Special Educators' Use of Technology To Promote Literacy. This case book is one of several products of that project.

A national survey of special educators' use of technology to promote literacy

In cooperation with CEC, Macro conducted a nationwide mail survey of special educators and received approximately 1,100 responses. Eighty-four percent of the respondents are special education teachers. The remaining 16 percent are administrators or related services specialists.

Nearly all respondents use some kind of technology with students with special needs, while four fifths state they use technology specifically to improve student literacy. The major categories of technologies used include audio and video equipment, computers, and adaptive and assistive devices. Approximately four fifths of respondents use audio and video equipment. Most state that these materials improve listening and oral expression. Reading the captions on television programs and following the text of audiorecorded books help reading skill development. Educators suggest that some audio and video materials could challenge critical thinking skills.

Slightly more than two thirds of respondents use computer technology with their students. Educators use various computer applications, including educational games, drill and practice, word processing, graphic arts, databases, telecommunications, and

desktop publishing. In addition to increasing computer knowledge, this technology can enhance all areas of literacy.

Approximately 26 percent use assistive computer input devices, adaptive output, or motor assistive technology (e.g., switches, alternative keyboards, augmentative communication devices, Braille printers, and FM systems). Respondents use these technologies to provide access to other technologies and offer opportunities to develop literacy skills.

Macro selected about 200 mail survey respondents to participate in telephone interviews about their specific programs. These individuals had indicated that they frequently use technology to improve student literacy skills and that they possess several years of experience with educational technology. Nearly three quarters of the sample are special education teachers, and about one fifth are

administrators. The remaining participants are related services specialists.

Across the board, interviewees state that technology allows students with disabilities to accomplish things they otherwise could not do without difficulty, or could not do at all. They say that technology increases students' access to educational material and helps develop literacy skills. It motivates students to learn, increases ability to focus on material, and improves student attention span. Technology also increases task completion, eases teacher monitoring demands, and raises the level of student independence.

From the telephone interviews, Macro selected several programs in which to conduct a series of case studies. These schools and school districts address the needs of students with various disabilities with a variety of educational technology solutions. This is not a "best practices" document in the sense of a competition between programs. The purpose of this case book is to spark new ideas for educators by highlighting some well-functioning programs that are successful on their own terms.

Case study research with literacy programs for students with disabilities

During the 1996-1997 school year, teams of educational researchers visited a variety of programs throughout the U.S. The objective was to determine how individual schools or school districts address special education needs within the context of their own program. During each case study, researchers gathered an array of data on the links between teaching literacy skills to students with disabilities and specific technological solutions to educational challenges. The teams observed classrooms in action, interviewed administrators and teachers, and talked with students.

Morristown Elementary School, located in Morrisville, Vermont, may look like a typical elementary school, but it is exceptional in many ways. Principal Fredericka French, a special educator by training, presides over the education of approximately 600 children in kindergarten through fifth grade. With a technology-rich program, this school is thriving under a State-mandated and locally embraced full inclusion policy. The district has a relatively high percentage of families living in poverty and

receiving public assistance. The town is growing rapidly as people immigrate from southern New England States to Vermont.

Red Bluff, California, is the county seat of Tehama County in the northern reaches of the Sacramento Valley between San Francisco and Sacramento. It is a rural locale, with about 12,000 residents. Serving a geographic area of nearly 2,000 square miles, Red Bluff Joint Union High School educates an ethnically diverse student body of 2,200 in ninth through twelfth grade, despite being designed for 1,500. This high school has an integrated and effective alternative program for students with severe emotional disturbance, conduct disorder, and other causes of being at-risk. This case study focuses on the White House program for students who have a conduct disorder or severe emotional disturbance. Technology allows a nurturing, safe, challenging, fair, consistent but flexible, and educationally rich environment that benefits its students.

With a population of 12,000, Stuart, Florida is the largest city in Martin County. This county has over 100,000 residents. Stuart sits on Florida's east coast between Miami and Jacksonville. It is home to South Fork High School, one of the county's two high schools. According to district documents, South Fork served about 1,440 students in ninth through twelfth grade. Featured here is a program for students with moderate or severe cognitive and physical disabilities who are mainstreamed to the fullest extent possible. A range of technologies is critical to this effort.

The Metro Nashville School District in Tennessee serves 73,000 children in 122 schools. The student population includes approximately 10,000 students who receive special education services. A dedicated technology lab staff provides focused assessments and ongoing training and technical assistance with students and teachers. This case study focuses on how district personnel collaborate to provide services to students with visual impairments.

Dade County Public Schools Prekindergarten Exceptional Student Education Program in Florida provides services for approximately 2,000 preschool children with a wide range of disabilities. The district provides services in 107 classrooms in 61 schools as well as in medical care facilities and home-bound programs. This large county spans 50 miles and includes the city of

Miami. Over 350,000 children are enrolled in Dade County Public Schools. Here a modified motor coach travels to students and teachers for efficient and effective needs assessments, training, and followup.

Palm Springs Middle School is located in Hialeah, Florida, an urban suburb of Miami. The city has nearly two million residents. Hialeah has a large minority population and a high percentage of economically disadvantaged families. There are approximately 2,400 students attending the school, which is nearly double its capacity. Despite these challenges, school personnel support several successful special education programs. Highlighted here are the efforts to support the mainstreaming of deaf and hearing impaired students as they expand their literacy skills.

Oakland County Intermediate Unit, in Madison Heights, Michigan, is situated in a large suburban county near Detroit, with 28 districts serving approximately 300,000 students. Among other programs, the Oakland County Intermediate Unit operates a center for students with autism and provides services to students with autism who are placed in district self-contained or mainstreamed classrooms. Approximately 150 students receive services in center-based programs, and another 150 receive services in neighborhood schools. This profile focuses on ways technology helps develop communication and independent living skills.

Themes

Across all case studies, several themes emerge. Many educators are striving to have technology move to the background. As many teachers say, they intend for technology to be a means, not an end. They hope to focus attention on learning and student products, not technology itself.

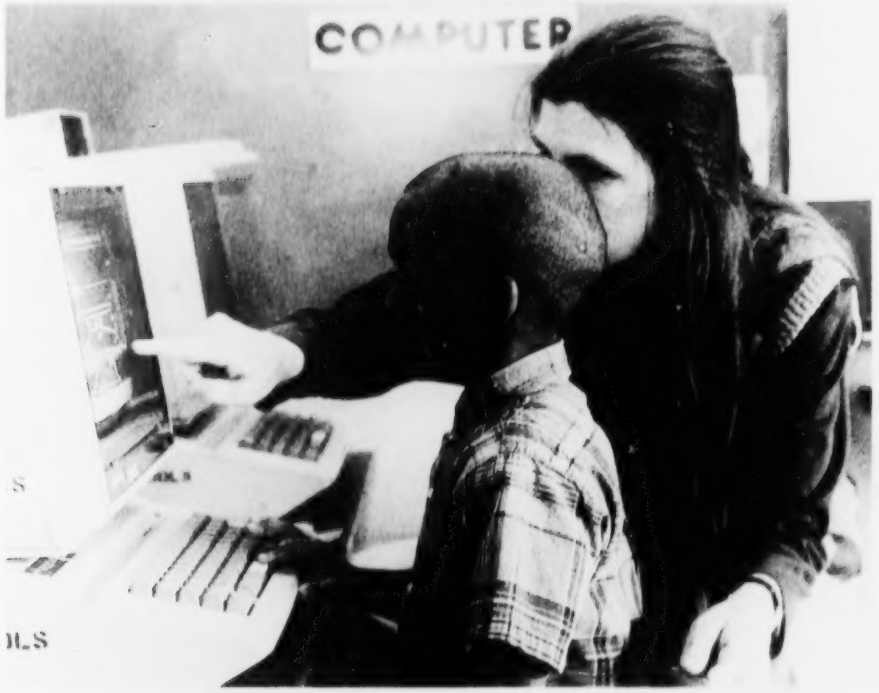
Many educators demonstrate that technology does not have to be complex or expensive to be successful. Simple technology can produce high returns. Further, these profiled cases illustrate that there is no relationship between disability severity and technology complexity. Often the lowest technology solution opens as many doors for students with learning disabilities as for students with severe disabilities, for example. At the same time, students with severe disabilities can find as much enrichment with the most sophisticated equipment as can students with mild disabilities. Teachers often use the same piece of equipment with students who have different disabilities or learning objectives. One of the benefits of technology is the flexibility it affords. Special education teachers know, perhaps better than most, that solutions need to be designed for specific individuals.

While this project is not about mainstreaming or inclusion, these placement issues are a fact of life for special educators and their students. This collection of stories illustrates that, whatever student placement decision has been made regarding least-restrictive environment, technology can promote its success. That said, many teachers state that technology is important for integrating general and special education students.

In line with the role that technology can play in mainstreaming efforts, several teachers and administrators observed that the benefits of technology for special education programs can infuse entire schools. This benefit is especially apparent where there is a high mixture of general and special education students. Students who are assigned laptop computers for special education needs, for example, can become classroom experts at software. Informal peer teaching emerges when the student with a disability is the instructor. Similarly, many general education teachers praise their counterparts in special education for modeling innovative solutions to classroom issues.

A few programs described here have benefited from large influxes of State and Federal grant money. However, the majority

of these cases demonstrate that establishing effective instructional programs are possible with limited resources. Great strides can be made with a few choice investments in equipment, needs assessment, training, and technical assistance. Underlying all is an effort to economize efforts, focus on specific needs, and share solutions. Collaboration between internal and external resources and personnel is one common way many programs economize.



Each program makes careful decisions about spending funds.

Many of the featured sites demonstrate the importance of careful needs assessment of students, intensive teacher training, and ongoing technical assistance. Some provide training and assistance in target students' classrooms. This assistance increases the likelihood that technology decisions will be a better match and that technology will be used effectively. In this way, the efficiency of the entire process improves.

Educators often discuss unanticipated results from successful matches between student needs and technology. Where literacy skills are targeted with a technology, social skills improve. Many students find pride in their schoolwork only after being able to create neat, clean documents with the aid of a computer. Learning and teaching technology to others, students gain experience relating with their peers in new ways. For others, technology develops specific literacy skills that enable students to express themselves and interact in newly discovered ways. Many students' motivation increases with the presence of a technology. Increased motivation often leads to literacy skill development.

The following profiles provide concrete examples of technology use in different instructional settings. The case studies demonstrate how various educational philosophies and implementation efforts help schools build successful technology-based instructional practices. While programs address distinct special education needs within unique contexts, their stories offer all special educators insights into how educational technology connects with literacy.

Supporting full inclusion

Full spectrum of disabilities

Morristown Elementary School, Morrisville, Vermont

Being a small district in a small town has not kept the Morristown School District from active involvement in the educational reform activities of the past decade. All 600 students are fully included in the mainstream, and the use of technology allows all students to improve their range of literacy skills.

The district is a former member of the National Alliance to Restructure Education. This collaboration sought to help good schools become better schools by assisting with district strategic planning and the incorporation of technology into the educational process. As Principal Fredericka French said, "These wonderful thinkers and national level experts were talking about the very same issues that we were talking about locally. I think we made some major leaps forward in a number of areas. It was the shared expertise that really revved people up." In this spirit of reform, educators in Morristown often reflect on what they do, why they do it, and how they can do it better.

Vermont law specifies that all children be educated together in the general education setting. In Morrisville schools, there are no self-contained special education classrooms. One of the district's special educators sees full inclusion in a positive light:

> *There was much more of a distinction when we had special education classes. At that time, I worked with learning disabled students in a resource class, but students with more severe needs were in a special class. Everyone knew what class they were in and they were definitely not part of the mainstream.*

Meeting State curriculum standards while accommodating diverse student needs requires teachers to step back and ask themselves, "What are the real goals? What are the real objectives? What is it that the district really wants everybody to learn?" Teachers must adapt what the class is doing for those children who

simply cannot do the same thing in the same way. In the end, although student achievement levels vary, all students have the same opportunities to learn. Success depends on everybody's communicating and collaborating. As one teacher said, "So long as all of us do our part and everyone communicates effectively, it works really well. I think it is a great system. We keep working to make it better, but it is pretty wonderful right now."

Currently, trained special educators work with classroom teachers to plan and implement appropriate instructional programs for students with disabilities. These consulting teachers include speech/language pathologists, guidance counselors, inclusion facilitators, reading specialists, and paraeducators. Children receive special education services in classrooms or in pull-out sessions, depending on the need.

Technology initiatives to support district philosophy

Morristown has a keen interest in using technology to promote learning. The district is committed to integrating technology into the instructional programs of all students. The administration's decision to move the computers out of a lab setting and into classrooms marked a turning point in the school's approach to using computers. As the district technology coordinator explained,

> *Just about anyone who thinks about technology would want to see it used as a tool, something that gets integrated and supports whatever people are doing in their classrooms. When computers were in the lab, teachers never really learned to integrate computer use with other things that they were doing. And so the idea was to put the machines in the classrooms and have them always available to the students.*

Along with acquiring and maintaining equipment, the technology coordinator is responsible for helping teachers use technology to support student learning. This use involves formal and informal professional development activities focused on skill development and curriculum integration. A technology action team supplements the technology coordinator's efforts. This group, composed primarily of teachers, provides training and has developed a long-range plan for technology in the district.

Participating in the Apple Classrooms of Tomorrow (ACOT) project has greatly influenced how the district uses technology. Currently, three of five ACOT classrooms are in the main elementary school building, primarily in fourth and fifth grades. Each ACOT classroom has four or five Apple Macintosh computers (including one laptop), printers, a flatbed scanner, a

large-screen television set, a digital camera, a camcorder, and several AlphaSmart portable word processor keyboards. While there is not one computer for each student, there is enough equipment to be infused in the instructional program.

Use of portable electronic keyboards is the school's solution to the limited number of computers. Each machine has a small monochrome display and comes with an adapter. The adapter allows a user to transfer files to a computer or directly to a printer. In order to check spelling and format text, students use computer software such as ClarisWorks. The AlphaSmart keyboards are simple and durable, and teachers consider them very affordable. Teachers also point out that the AlphaSmart's simplicity has advantages for some students with disabilities. Students with attention difficulties or emotional or behavioral problems seem to focus better on the writing task when using the keyboard than when working on computers. Teachers attribute this ability to focus to AlphaSmart's small screen and lack of options. There is no capability to change fonts or colors. There is no other software to explore. Some students with fine motor problems also have found the AlphaSmart keyboards useful, and one student has even been assigned a keyboard full time for all of his writing and note taking.

Many of the other elementary classrooms operate with an ACOT spirit, even if there is somewhat less technology available than in the designated ACOT classrooms. Throughout the district, teachers have adapted the ACOT model to support the State and district philosophy of full inclusion. As one teacher said,

> *Early on, one of the things that ACOT teachers in other districts constantly reminded us of was that this could help the school be even more inclusive than we could have been otherwise. We had a philosophical commitment to inclusion, but here was yet another way to really act on that commitment.*

The instructional approach is more remarkable than the amount of technology in the ACOT classes. Instead of working in isolation, students learn and practice skills together while working with the content of the curriculum. Students construct their own understanding and acquire basic skills as they work on individual and group projects and presentations. Students also receive direct instruction in groups.

Teachers emphasize student exploration and hands-on learning in ACOT classrooms. Students rarely sit down and do the same thing at the same time. The classrooms hum with activity, and every student, including those with disabilities, is fully involved in the activities. Rather than listening to teachers lecture, students are

actively engaged for extended periods of time in multidisciplinary work. Students write, create art, and work with manipulatives in math and science. Students often work together to produce a report or presentation in heterogeneous groups, and students are very supportive of peers who may need a little bit of help. When additional assistance is needed, paraeducators and teachers are available to provide it.

Instructional uses of technology

Students use computer technology as a means to a project's end. They rarely use computer-assisted instructional programs. As one teacher said,

> *We don't have a lot of things on our computers. We have ClarisWorks and we have HyperStudio and a few other pieces of software. We want to put as much control in the hands of the learner as possible. And that is why 'tool programs,' word processors, spreadsheets and other things like that, are what we decided to use.*

Other applications used regularly include a semantic mapping program to help students organize their thoughts for writing, Mavis Beacon for keyboarding, several simulations that are related to curriculum content (for example, Oregon Trail, The Great Solar System, The Great Ocean Rescue, and Carmen San Diego), HyperCard, Grolier's Multimedia Encyclopedia, and other resource compact disks.

An underpinning of ACOT classrooms is the notion of process-product-content. These dimensions of learning are seen as inseparable, so students frequently work on developing products that reflect their understanding of the curriculum content. Students have the freedom to make many choices. Some students may choose to develop a product using technology and others may elect to use more traditional tools. For instance, students had recently completed a unit on explorers. For this unit, each group of three to five students was assigned a country and each student selected an explorer to research. This project covered basics topics such as maps and flags, but also involved in-depth investigations of the explorer's world, including art, music, and politics of the era. Many groups opted to make a multimedia presentation of their research. Students gathered information and scanned images from books, resource compact disks, and the Internet. Most students incorporated music from compact disks. This and other projects may take 2 to 3 weeks to complete, with students typically working on a project for about 1 hour per day.

Students in the ACOT classrooms do a great deal of writing, and technology use is infused into the writing process. In most classes, students engage in 1 to 2 hours of language instruction per day, with about 30 to 45 minutes devoted to composition. The weekly schedule is as follows: Monday is for prewriting activities; Tuesday is for producing a draft; Wednesday is for revising the draft; and Thursday or Friday is for publishing. Some students use 2 weeks rather than 1 to complete the cycle. The early process involves handwritten work, with computers used for publishing. Students who have poor fine motor coordination use the computer throughout the writing process.

Some students with a learning disability or poor fine motor control have difficulty producing a handmade finished product they find attractive. Computers have made it possible for all students to produce work of which they can be proud, and students take advantage of the opportunity. A teacher recounted one story about a boy who had a severe learning disability:

> *Getting him to put anything on paper was an absolute struggle. This boy came in one day and said, "I delivered my first calf last night." He was so excited that I*

recorded his story about it. He sat down at the computer and typed it up. I went through the editing with him a little bit, but I didn't change the story. We printed it out and this great big boy stood there in front of me with his paper and said, "I've never had a paper look as pretty as everyone else's." And my heart just about stopped. He then copied his paper and gave it to every teacher he had ever had. That was what technology had done for that child.

Another teacher described students' willingness to make changes in their work when using computers. "One thing we have noticed is that students will continue to improve their work. They don't mind making changes and proofreading on their HyperStudio stacks. They want to go back and refine and fine-tune things. This is a really important skill."

Classroom technology also has provided ways for students with various learning styles to excel. Students who would not normally be successful in a traditional classroom can take on leadership roles and gain confidence from teaching peers about technology. One teacher described working with a group of at-risk students: "I am convinced that technology saved them. [The benefits] followed through over to the seventh grade and beyond. They are now technology experts over there." Another teacher told a similar story:

In the first year, we had a boy who had attention problems and was hyperactive. Well, he amazed one of his former teachers when he sat down and taught her how to use HyperCard. He had done independent study on the Titanic and he showed through animation the Titanic sinking and explained the number of compartments on the ship that had been destroyed. He became an expert at doing it. For some at-risk kids, it can be an absolutely amazing motivator.

Summary

Morristown educators believe that students with disabilities benefit from full inclusion and technology-rich classrooms. Some said that students blend much more easily in a setting in which students are working at their own pace and collaborating with their

peers. Children help one another, and students who do not understand are more willing to ask for help than in a traditional classroom. Sometimes a teacher or other adult helps, but students often use one another as resources. A lot of intense discussion occurs as children grapple with complex problems. As all students work together, children with language delays have the opportunity to interact and learn from peers and teachers who have more highly developed language skills.

The district's involvement in the ACOT project was fortunate because it provided additional resources to the schools. Nonetheless, the district has a history of involvement in educational reform efforts. Staff adapted the ACOT model to the educational philosophy of the Morristown district. This process involved taking into account the needs of students with disabilities.

Developing a successful instructional program has required a great deal of effort from everyone. However, most see it as rewarding both in terms of teacher professional development and student outcomes. All students are developing computer literacy as they improve their basic language skills in the context of meaningful cooperative learning efforts and growing composition skills.

Building skills and motivating students

Severe emotional disturbances and conduct disorder

Red Bluff Joint Union High School, Red Bluff, California

Red Bluff Joint Union High School's alternative programs keep many students in school and increase their chances of benefiting educationally and socially through school attendance and participation. Several alternative programs serve students who have severe emotional disturbance or conduct disorder, who are recovering from drug and alcohol abuse, who are not functioning well in the mainstream, or who have dropped out in the past.

This case study highlights the efforts of the White House Alternative Program, so named because it is located in a white house. The program operates in close conjunction with the other alternative programs and Red Bluff High School. However, it is considered a school unto itself. The White House serves between 20 and 25 students. These individuals exhibit the most severe acting-out behaviors and have been classified as having severe emotional disturbance or conduct disorder.

According to a district report, the program's uniqueness and success in part can be attributed to "the homey environment and culture and to having both groups in the same facility along with the ability to mix the students or separate them as needed."[4] Mixing students lets individuals with severe emotional disturbance learn how to be assertive from students with conduct disorder. Students with conduct disorder learn how to retain control and use it nondestructively. The instructional facilities have been designed to separate students with conduct disorder and students with severe emotional disturbance when it is needed. School personnel knew these students could not typically occupy the same classroom without disruption. The teachers have arranged the instructional space as if it were a library with distinct work tables for individual or group activities.

Many White House students have nontraditional learning styles, according to one administrator. Many benefit from hands-on learning activities, and several have problem-solving deficits.

Frustrations borne of these difficulties can be better addressed in the alternative program. The White House succeeds by approaching each student as an individual with a unique history and set of interests. In one teacher's words, staff make the school fit the student, not the other way around. The White House, the teacher said, tries to "help students find a niche in the world."

Instructional philosophy and content

The teachers address identifying characteristics first. They have found that educational goals can be achieved once behavior can be better self-managed. "Basically our number one concern is behavior," said one teacher. "Once we get behavior stabilized, then we start to plug in with academics. For some students, [this includes] survival skills, writing a checkbook, opening an account, creating a budget, mastering basic addition and subtraction, and working with a calculator. Then once students have a grasp of that, then we start working with other things they need to know."

Students work on a self-directed pace with tasks they select from teacher suggestions. Students find additional motivation to complete assignments from an underlying behavior modification system in which students receive points for completed work. Rewards and privileges are gained or restricted according to task progress. For example, students can elect to have some down time, but only if they have accumulated enough points. One teacher stated that students are empowered when they take control of the material and work independently. Feeling empowered, this teacher said, fosters student motivation.

Students work on developing various literacy skills simultaneously. Educators initially focus on ensuring and improving the foundation of one's skills. "If it's a word problem, they're going to need to know how to read it and comprehend what the question is asking. . . . If they have low reading skills, then their math suffers." The overall objective for literacy skill development is improving students' employability. In keeping with this orientation, White House teachers incorporate social skills into the operational definition of literacy.

Teachers find they are given many opportunities to be creative both in their classroom management and in their approach to curriculum delivery. One teacher praised the superintendent for being open to teacher input. "At Red Bluff High School the superintendent is very open and willing to try to do new things and listen very openly to the teachers. When they get excited about something, he gets excited. [When teachers] say that maybe this is something we can use, [he says] show me what you can do with it. And then it just kind of happens." This educator added that the superintendent's support for technology had increased within the

last 3 to 4 years. "But I think it was a concerted effort on his part to get the technology to the point that it is today."

Another factor in their success is that all staff recognize the need to continually learn and discover. "I think the key is that we don't know what we are doing," said one teacher. "To know that is really empowering." This belief has led Red Bluff Alternative Program staff to collaborate with each other and with the school's general education teachers. Program staff value the insights and ideas of general education teachers as well as special educators. Red Bluff staff believe that all teachers can learn from each other.

Computer use

Red Bluff Joint Union High School and the alternative programs use a variety of computer applications to develop a wide range of literacy skills. The majority of software titles are off-the-shelf commercial items. For example, students complete desktop publishing tasks with PageMaker, while a typing program called UltraKey promotes keyboarding skills. Several students use HyperStudio, a digital camera, and a scanner to create multimedia presentations. Like HyperCard, HyperStudio packages information on index cards with links between cards.

One student-created HyperStudio product organizes mathematical concepts such as properties of operations and definitions. The use of sounds and colors makes it an attractive package. In creating his work, the student learned HyperStudio and refined his knowledge of math concepts. At the conclusion, he had a stand-alone product to show prospective employers and the White House had a tutorial program for future students. Other students create HyperStudio products on topics of more personal interest, such as favorite music groups. In creating these programs, students explore Internet resources and use a scanner to develop program content. The teacher stressed that projects must be

created on a storyboard first. This method gives students a document that guides their computer development and keeps them on track, but also forces them to apply planning and problem-solving skills.

One teacher's innovation was to adapt help files that come with many word-processing programs into an instructional unit. Learning the different functions of the program, such as spell checking or text formatting, is now something students work through systematically. Many of their efforts to learn ClarisWorks, for example, are tied to the school newspaper, which students publish every 6 weeks. While students learn computer skills in order to contribute to this effort, they also hone their writing skills.

Use of video technologies

Students in the White House program also use video technology in the main high school. Some have created music videos modeled after what they have seen on television, while others have produced instructional videos. Students develop and practice writing skills, and they fine-tune their abilities to plan actions and organize ideas. Students also gain an appreciation of the difficulties associated with video production. Every student takes on an individual part of the project, but each also is graded on the final group product. They improve their sense of consequences of actions, the value of teamwork, and knowledge of work responsibilities.

> *When we made the music video, for example, students thought, "Gee this will be easy, I just take a song and write the lyrics down and throw some footage to it and then it's done. I'll have it done in a day." It's that sort of mentality. They don't realize how much work actually goes into professionally making something like a music video that's aired on MTV until they have sat down with a stop watch so that key phrases in the song would be able to match up with the video. . . . It's not as easy as they thought it was going to be. It's actually a lot of work. It takes a lot of cooperation. There's nothing worse than being in a group and a person in your group has taken responsibility to go shoot a scene over the weekend but they come on Monday morning and they didn't do it. Students learn how important it is to be part of a team and that people depend on you to follow through.*

Summary

Red Bluff Joint Union High School has focused on improving the academic lives of students with disabilities and those who are at risk. It has created an atmosphere that encourages staff innovation and collaboration. It provides a separate, nurturing, and safe educational setting that is rich with technology. Critical to the success of the White House and other alternative programs is the context in which the teachers work. Time and again, evidence suggests that this is a district that is open to new ideas and creative ways to solve ordinary problems. Technology helps students develop their writing, computer ability, math skills, and work-related skills. Finally, technology improves many students' ability to focus on a task.

Establishing early literacy

Moderate and severe cognitive and physical disabilities

South Fork High School, Stuart, Florida

Martin County, Florida is home to South Fork High School. Special education in Florida is administered through local departments of exceptional student education (ESE). In this high school, ESE has grown significantly over the past few years. The student population served has doubled and the number of staff has tripled. Currently, 18 teachers instruct approximately 175 students. This case study focuses on a program that teaches students with moderate and severe disabilities, including moderate mental retardation, physical disabilities, and speech and language disorders.

The South Fork program serves approximately 15 students. Some students are able to communicate vocally, while others use alternative communication devices to express basic needs. Many students have cognitive deficits, and several have problems with fine and gross motor dexterity that affect mobility and ability to write. Through a variety of technologies, students become increasingly equipped to interact independently with the world around them.

Lead teacher Doris Davis manages this ESE program. In addition to teaching responsibilities, Ms. Davis purchases equipment; stays current on technology, curriculum, and educational innovations; and meets with special and general education teachers. Two assistants help students in and out of wheelchairs and other special devices, ensure that students can get to their classes, and help them in mainstream classes. Several dedicated general education students also help ESE students complete work, aid in the use of computers and communication devices, and provide assistance during class trips. A few general education teachers have made an extra commitment to accommodate the students in the mainstream.

Special education staff want individuals with disabilities to interact with the general education population as much as possible. One school counselor said of Ms. Davis, "She goes out and finds

teachers who want to work with students with special needs. In fact, teachers volunteer. . . . We find that many times they provide a great deal in our general education classrooms." This attitude toward mainstreaming distributes benefits to all students and adults, not just special education students. As one teacher explained, mainstreaming has resulted in increased acceptance of special education students.

> *We have opened up an opportunity for all the students in the school to be contributors to the education of these young people. And our students who have mild learning disabilities and emotional problems have gone to work as aides to help students with disabilities. And they learn technology that way. They improve their literacy because they are practicing their own skills while they help these more impaired students. This is true of the [general education] kids who come in as aides also. Many students have seen careers open to them that they would have never thought possible. They are beginning to realize that this is a place where [they] could make a contribution as an adult. So in working together, everybody has benefited.*

Helping students adjust to, accept, and use schedules is a critical step toward thriving in mainstream classrooms and preparing them for independent living. Improving written and oral communication, basic mathematics, and other literacy skills increases students' ability to be mainstreamed and their success in general education classes. A special education teacher said of Ms. Davis' program, "The most important thing is giving [students] life skills needed to function independently or in some sort of supported fashion once they leave here. That would be my definition of how we view literacy."

The program increases students' sense of accomplishment and reinforces student effort. When students can identify words or letters, respond to a question from a peer, or write an e-mail message, students feel that they have achieved something.

The primary aim throughout the high school is to give students the skills needed to graduate with a standard high school diploma. Technology has made this possible for many more students than in the past. Technology provides abilities absent due to physical or cognitive disabilities, promotes academic achievement, and increases student motivation to learn.

Many factors contribute to the success of South Fork High School's program for students with moderate and severe disabilities, and one is the emphasis placed on collaboration. Educators collaborate with one another because they hold the attitude that they can always improve. Teachers also believe in collaborating with students when assessing which technology will best meet their needs. In addition to providing a better match, their participation also increases student buy-in.

Reflecting special educators' penchant to try anything and use whatever works, a teacher said, "I think that whatever we can bring in from any direction, whether it's computers, individual aids, or sophisticated calculators, has a big impact." After finding the technology appropriate for specific students and reviewing the current lessons, Ms. Davis realized that students could do many more technology-based activities by themselves than with traditional lessons. Also, students increasingly found the class more interesting than when they were not using technology. Now Ms. Davis incorporates technology into as many activities as possible, if not all. Technology seems to increase students' motivation to participate in classes and learn. Some express the desire for more homework. Technology helps students be more actively involved in their own education. Ms. Davis stated that students do not passively read or listen. Students internalize a new sense that they have the power to do things on their own. They do not seek help from adults as much as they previously did. Students have a greater sense of self-reliance and independence.

Computer use to promote reading, writing, and oral expression

Computer use is emphasized throughout the high school curriculum. One teacher remarked how every employment opportunity now requires computer knowledge. "It doesn't make any difference if students are going to be working in an office environment or if they are going to be a plumber on a truck. We try to make students as comfortable as possible with the resources and computers that we have." Another teacher discussed how valuable a laptop is for a student with cerebral palsy and how the technology allows this student to accomplish things that she otherwise would not be able to do:

> *[Many people] look at this girl and think she is really not going to be able to function. But we know that this girl has a bright brain inside her. And she has lots of surgeries and lots of physical problems, but once she's here and in mainstream classes, this student is where she belongs intellectually. And she enjoys the stimulation that she might not get in a different setting. All of us should all be able to go wherever our abilities and interests take us. And technology has certainly made that possible.*

Computer software is a vital tool to help some individuals write. Some students with poor fine motor control benefit greatly from computer-generated text. With word processors, composition skills are separated from the mechanics of writing. One student said, "When I first came to high school, I was writing everything by hand. I can write, but not as well as everybody else. So that's the problem. I would rather use the computer to type because it is a pain in the neck to write. It is much faster and easier for me." While some students have problems writing because of the physical

mechanics involved, others have difficulty because of poor spelling or difficulty organizing their thoughts. Poor spelling ability intimidates some students to the point of stifling written work. When they know a word processing program will assist with this aspect of writing, students are freed to put thoughts down and rearrange ideas without erasure marks or misspelled words marring their work. With word processing, these students can produce original written work with few mechanical errors, and they have less anxiety about writing. In addition to the benefits from increased writing practice, teachers observe that word-processing software boosts student self-confidence.

Word prediction software helps some students overcome word retrieval and grammar difficulties. When an individual types a word, Co: Write offers several predicted choices for the next word to be typed. The application automatically adjusts for proper capitalization and spacing.

The software Write: Out Loud helps several students in Ms. Davis' class with oral expression. This application speaks words as they are typed, helping students learn the pronunciation of new vocabulary.

Computers also help develop reading skills. One teacher remarked, "I have found that computers have given kids motivation to improve their reading. And that often is kind-of through the back door because you give them a neat thing to do on the computer. [To them] it's not a reading lesson, it's a game."

Applying literacy gains with the Internet

The Internet supports several instructional activities, such as a diary project with a California school where students type journal pages and contribute other works. Students also communicate regularly by e-mail with educational news programs, such as Channel One, and with e-mail pen pals. On at least one occasion, the class received a reply from the White House in Washington, DC. Students also find information on the World Wide Web. One student, for example, researches her favorite New Orleans restaurant. She looks for information on prices, menus, and chefs. She even contacted one of the chefs to tell him how much she enjoys watching his televised cooking show and that she wants to try his food.

Overall, the Internet provides students an engaging environment in which to practice language and writing skills. Using the Internet has increased some students' attention span. Teachers also have noted that students' manual dexterity gradually improves in the presence of this motivating technology. One student who began by typing with one hand now uses both on the keyboard. Further, students learn that their thoughts can be expressed meaningfully to others. Finally, with newly acquired computer skills, the students take pride in sharing the same set of skills they see general education students using.

Icons and alternative communication devices

Ms. Davis started using Boardmaker for a few activities, especially labeling items. Most of the items in the classroom, such as the door, pencil sharpener, tape, and stapler, are labeled with icons and titles. Over time she discovered its applicability in many other areas, including developing reading skills. Now, Ms. Davis uses cards created with Boardmaker for every student in her class. Some students even create their own icon cards. As a student's word recognition improves, the teacher gradually decreases the size of the icon and increases the size of the text. This helps students become dependent on words, not pictures.

The cards are also used outside of Ms. Davis' classroom. For example, on the occasional field trip to a restaurant, students with limited or no reading ability use colorful laminated menus with

pictures of food and titles. Students tell the server what they want by pointing to pictures and words on their menus. Other students who have difficulty processing information use icon lists to help with task completion. The lists remind students what they have done and what they will do next. One student, for example, uses instruction sheets with Boardmaker icons to help clean and set up a home economics laboratory. Each storage cabinet has lists with icons that match written instructions detailing where items are kept. As the student increases her ability to identify words without icons, her teacher switches instructions to text. Boardmaker helps to teach prereading skills and basic reading capabilities and has enabled non-verbal students to become active participants.

Two nonverbal students in Ms. Davis' class use the alternative communication device AlphaTalker. When an individual presses a button, a voice speaks a prerecorded word or phrase. Picture overlays, often created with Boardmaker, identify what each button represents. A picture of a hamburger, for example, may represent "I am hungry." Students form complex sentences by pressing a series of icons. Students learn that pressing a particular picture consistently triggers certain words. They continue to learn and create increasingly complex thoughts by combining several buttons.

Summary

Through one teacher's initiative and leadership, South Fork High School's program for students with moderate and severe disabilities has helped its participants achieve remarkable gains in literacy and life skills. These gains would not have been possible without also having general educators committed to mainstreaming. Students have acquired job and social skills in addition to language, reading, and writing gains. Ultimately, their independence has increased. With an underpinning of technology and a belief in the potential of supported inclusion, students have entered and succeeded in mainstream classes.

Collaborating to identify needs and deliver services

Visual impairments

Metro Nashville School District, Nashville, Tennessee

The Metro Nashville School District provides high-quality services to students with visual impairments. The vast majority of program students have low vision. A few students have no vision. Most have disabilities in addition to visual impairments. This case study focuses on technologies that help students overcome barriers to literacy skill development posed by their visual disability.

The district leadership changed recently after having one superintendent for over a decade. The new superintendent brought dramatic changes to the district. Many of them affected the special education programs. Margaret Horsnell, director of special education, described the change:

> *[There is] a real focus on the needs of kids, improving achievement, and a really different philosophy on special education. Now there is a real openness and acceptance and a tremendous amount of support for the department. With that support came a great deal of freedom to make changes and really get a handle on some of the populations. At the same time, there was an influx of additional Federal money through the State.*

The additional Federal funding made it possible to increase the number of staff in the central office and to provide additional support to both general and special educators serving students with disabilities. Consulting teachers offer staff development, training,

instructional support, and mentoring to administrators, teachers, and parents.

The district also benefits from the proximity of the Tennessee School for the Blind. Further, nearby Vanderbilt University, which has schools of education and medicine, offers exceptional resources for consultation, collaboration, and staff training.

Although the vision program staff are distributed throughout the district, there is a strong sense of cohesion. They meet regularly, work on committees, conduct training sessions, and implement special projects. Their obvious commitment to the program has made them welcome in schools throughout the district, with teachers and administrators alike viewing them as a valuable resource.

Metro Nashville provides services in all educational settings. They serve students in general education classrooms and self-contained classrooms in neighborhood schools as well as in special centers. The special education department believes that the continuum of educational settings is important and that it should be maintained. As the director said,

> *Our position is that children should be served in an appropriate program in the least restrictive environment, and so we always look at the general classroom first. However, we believe that the law put a continuum there for a purpose. . . . We try to make the more restrictive settings short term, always with the goal of moving back to less restrictive. We have been moving towards serving children in their home schools and we have actually been able to do that a great deal more than we have in the past. But it's a combination. I think we're trying to be very diverse in our models.*

Technology needs assessment and training

Finding technologies that help the student is paramount, but that does not necessarily mean being on the cutting edge. The technologies in use range from fairly simple devices to complex equipment. As one technology specialist said,

> *I think we have made some progress in helping people understand that technology doesn't necessarily mean the biggest, most expensive piece of equipment. We're trying to push the idea that it doesn't have to be high-tech. Low-tech can sometimes get the job done better and sometimes it is less frustrating to learn.*

The vision program assesses students for vision aids. For more complex cases, the vision program draws on the expertise of two technology specialists from the district's special education technology lab. This lab houses over one million dollars worth of equipment that is used in assessments and loaned to students. The lab includes many kinds of technologies, including computers, adaptive input and output devices, and augmentative communication devices. The technology assessment team serves the entire district by conducting school-based assessments to determine what technology would be most useful. Most students never come to the technology lab. Rather, the team goes to students' classrooms to conduct an initial assessment, introduce the student to the technology, conduct initial follow-up, and train educators working with the student.

A typical assessment requires multiple visits to a student's school. The first visit entails observing the student and talking with teachers and therapists who work with the individual. On the second visit, the technology specialist brings several items she believes might be helpful. After picking the most appropriate piece of equipment, the specialist instructs the student and teacher in how to use it. This process has become much easier as the resources in the lab have increased. According to one technology specialist, "A lot of times we do have the equipment here already at the lab that we can take out. But sometimes we don't, and even now we sometimes have to order a device just for evaluation purposes." Staff believe that the lab has allowed them to improve

services to students. This improvement in turn has boosted staff morale.

In addition to selecting and providing devices for students, the next essential step is teaching students to use these devices effectively. As a low vision project coordinator said, "We have 'circle time' with the young children. As they look at felt boards, big books, and that type of thing, we're teaching them to pop their distance vision aid up to one eye, focus it in, and see what they want to see."

Technology for visually impaired students

Visually impaired students use a variety of technologies, including personal low vision aids, closed-circuit television systems, desktop and laptop computers, computer input devices, talking word processors, Braille printers, Braille'nSpeak, Braille and large-print publications, and talking calculators. Program staff draw on a variety of nonprofit and public resources to provide students with instructional materials in an accessible format. Additionally, in the past 2 years they have participated in a low vision project funded by the state of Tennessee and conducted by Vanderbilt University.

One student uses a Braille'nSpeak device, which has proven to be an invaluable aid. This device is essentially a small computer with four large buttons that the student uses to type Braille code. It can provide audio output on demand, can be linked directly to a standard or Braille printer, or can be linked to a computer so that files can be stored and modified with a word processor. The student said,

> *It's like a Braille-writer except it's a computer [without a] monitor. It takes up a lot less room and it's a lot quieter. It has a calculator and it has the date and the time on it. I have a different file for each class. I do all my homework, and it automatically saves it. I bring it to school, and I hook it up to the printer and print out a copy for my teacher.*

This tenth grade student has been using a Braille'nSpeak since the middle of seventh grade. Although she is the only student in the district currently using the device, one or two others may begin to use it in the near future. As one vision teacher explained, there are few students in the system who are as proficient in Braille. Most of the students have low vision and can access print materials

with vision aids. A few students, including those who have recently lost their sight or are likely to lose it in coming years, are encouraged to learn Braille.

Standard closed-circuit television systems (CCTV) are extremely useful, though cumbersome, devices. These systems continue to be a valuable tool for students with low vision, and many vision resource and self-contained classrooms in Nashville have at least one closed-circuit television. CCTV consists of a television, an integrated video camera, and a platform on which to rest the objects, usually print materials, to be transmitted from camera to monitor. In addition to producing an enlarged image of the objects, the image is high contrast, which makes reading easier for many individuals. This system has a significant advantage over large-print books in that students can see pictures and diagrams.

Particularly for young children or for those with significant motor problems, CCTV has some definite advantages over handheld devices that require fairly precise movements.

For many students, personal low vision aids can eliminate the need to use CCTV. Low vision aids let students have an inconspicuous portable system at substantially lower cost. Distance vision devices help students with activities such as reading blackboards. Near vision devices include domed or bar-shaped magnifying lenses that lie on a page. They enlarge print so that students can read more easily. Although low vision aids have always been a part of the vision program, the collaboration between Metro Nashville and Vanderbilt University has increased the effectiveness and number of students using the devices. These low vision aids have dramatically decreased the need for large-print books, and program staff view this as beneficial.

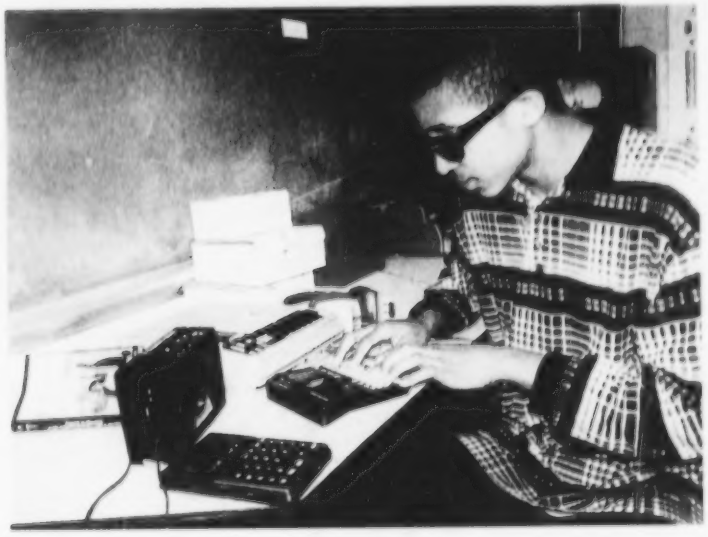
Low vision devices provide access to print materials and save money. While students would need new large-print books each year, a properly prescribed optical device will last for several years. The cost for both near and distance vision devices is approximately equal to one large-print book.

Computer technology has created opportunities for many blind and low vision students, primarily through speech synthesizers and text enlargement. The Nashville vision program makes computers available in vision resource and self-contained classrooms. A few students with both low vision and learning disabilities use laptop computers in classes and at home. One high school student described how he uses the equipment:

> *I mostly do school work and writing with my computer. I'm writing a book right now. I have Closeview and Write: Out Loud. I can make the type really big by going into Closeview, but I don't usually. . . . Before I had the laptop, I just wrote but I felt my writing wasn't*

legible enough. It's helped me improve my schoolwork. I'm doing a history essay. If I had to write it, it might not be legible. But I'm going to type it on my laptop so everybody can read it. I think what I produce now is better than it used to be.

Less complex technology also serves a role. Audiotape has long been and remains a valuable teaching tool for students who are blind or have low vision. Tapes can be used alone or in combination with other media such as large-print books, tactile books, or CCTV. For some low vision students with developmental delays that affect reading, audiotape may be the only way that these students can "read" a story. Some students who have no vision may be unable to learn Braille or may have just lost their sight and be in the process of learning Braille. For these individuals, audiotapes also prove invaluable. Staff say that the mainstream demand for books on tape in recent years means that a wide range of written material has been commercially recorded and is available at a reasonable cost.



In addition to playing books-on-tape, audiotape also is useful for its recording capability. Some students use audio recording for taking notes. Older students use audiotape to record classroom lectures. Finally, some students use audiotape for taking examinations and recording homework or reports.

Summary

Using technology offers students with visual impairments numerous benefits, including enhanced self-esteem, increased motivation, and improved productivity. Other benefits include improved literacy skills and employability once they leave school. Providing blind and low vision students with the technology needed to maximize learning is a challenging task that requires ongoing collaboration between special and general educators, technology specialists, and families. Metro Nashville vision program staff rise to this challenge.

Providing mobile needs assessment, training, and technical assistance

Full spectrum of disabilities

Dade County Public Schools, Miami, Florida

The Dade County Public Schools Prekindergarten Exceptional Student Education Program meets the needs of all children ages 3 through 5 who require exceptional student education (ESE) services in Dade County. The program is staffed by administrators, teachers, aides, technology specialists, related services specialists, social workers, psychologists, bilingual education specialists, staffing specialists, and parent educators. An instructional technology specialist, a specialist in multiple disabilities, and a speech/language pathologist compose the technology team, which is the focus of this case study report.

The district preschool curriculum is based on the belief that children learn best when they are active learners engaged in meaningful and developmentally appropriate experiences. The classroom structure provides children with many opportunities to be active learners. As one district document puts it, "Within our classrooms, the children are provided with opportunities to manipulate materials, choose activities, acquire skills with tools and equipment, solve problems, use small and large muscles, and take care of one's own needs within a carefully planned daily routine."[5] Structured activities offer children decision-making opportunities and learning experiences.

Program staff believe in using and integrating technology into the curriculum.

> *Technology is an important part of the daily routine. It may be the tool that allows a language impaired, autistic, physically impaired, or multiply impaired child to benefit from the curriculum. Low- and high-tech adaptations will enable children to communicate, play, and interact with their peers. These adaptations include the use of computers, augmentative communication boards, voice output devices, switches, and adapted toys.*[6]

Implementation of technology use

The Prekindergarten Resource Instruction Mobile for Exceptional Education (PRIME) Time Program was created to better meet program participants' needs. It provides children in each of the 61 schools and in three medical-care facilities with ready access to technology. The PRIME Time Program also offers teachers extensive technology support. During 1995, the instructional supervisor and a teacher who used technology extensively and trained others discussed an idea of using a specially equipped mobile home to bring technology to prekindergarten programs. After securing Federal grant funds, the ESE Program purchased and equipped a 29-foot motorcoach. Members of the technology team staff the PRIME Time van. These individuals have expertise in assistive technology and the ability to fulfill the program's mission of "support(ing) prekindergarten exceptional student education staff in Dade County Public Schools in their endeavors to provide low- and high-tech interventions for young children with disabilities."

Technology team members recognize that a needs assessment cannot be based on a single measure. The process begins with a technology specialist recommending a particular solution. The student has the opportunity to use it for a period of time while the teacher and technology specialist monitor the student. The technology team emphasizes that it is important to view the process as trial and error and not to expect a technology to be the magical answer. As one member of the technology team said,

> *We're not magic. We say, "Try this. See how it works. See if the kid likes it. See how the parent likes it. See if it fits into your curriculum and your day. See how you like it." And we'll be back in a week or a month to see how it's worked. Teachers frequently know what works, often better than we do. We just guide them.*

The technology team staff offer teachers a great deal of training and support. They conduct workshops that address technology issues relevant to the special education preschool population and provide individualized attention in teachers' classrooms. By traveling to classrooms, the team can provide hands-on training and technical assistance.

Technology specialists also offer individual and small group hands-on technology experiences for children. A wide variety of adapted toys and materials are available on the motorcoach for

children to discover their interests and abilities. When a piece of equipment proves helpful, the student often returns to the classroom with it.

The array of technology in the PRIME Time motorcoach facilitates language, social, and cognitive development in preschool children with disabilities. There are two high-end computers with multimedia capabilities, peripherals including Intellikeys and Touch Windows, a variety of adaptive switches, numerous augmentative communication devices, various adapted toys, multimedia equipment, environmental controls, early childhood and other software, a television and VCR, and other technologies. A section of the van contains materials that teachers may borrow. Another section contains equipment that teachers may use on the motorcoach. The latter includes a scanner and various software, such as Print Shop, HyperStudio, and Power Point. The PRIME Time Program has eliminated many bureaucratic obstacles that educators commonly face when attempting to obtain technology.

In addition to having access to the technology, program staff have funding available to implement teachers' ideas on altering their classroom's physical environment. For instance, a teacher of students with profound cognitive disabilities redesigned her classroom based on the layout of a teacher's room in another school. The technology team worked with her on the design and helped secure the needed resources. The redesigned room has improved the children's learning opportunities and safety. Now it is a "safe place where they can explore," she said. "The kids can just move around and play with whatever they see." The teacher has laid soft mats throughout the room and padded all of the counters and sharp edges with "noodles," the flotation devices used in pools. The teacher has placed many items above floor level to encourage the children to stand, and the noodles also prevent toys from falling off countertops. This room's arrangement provides a great deal of sensory stimulation and allows the children to use all of their senses. The classroom design also encourages children to develop different skills in different areas of the room, such as a gross and fine motor skills section. The emphasis is on having interesting activities for the children in an environment that is safe for them to explore, take initiative, and make choices.

Integrating technology into the curriculum

The technology team helps teachers integrate computers and other technologies into the curriculum by ensuring children's use of developmentally appropriate software. Children with profound mental disabilities, for example, use software applications that teach cause and effect. When a child uses an input device, such as an alternative keyboard, a touch screen, or a head-operated switch, something changes on the computer monitor. The child decides when to press a button to control when the page turns or what appears next on the monitor screen. For some, this decision making reinforces the concept of cause and effect. It also can allow lower functioning children to play an active role in their education. With higher functioning preschoolers, software applications are used to teach self-help skills, language skills, and prereading skills. In addition to having a mouse for those who can use standard input devices, all classrooms have Intellikeys or other alternative keyboards available. Many classrooms have touch screens, adaptive switches, and other adaptive input devices.

Students use various applications to mirror real-world activities. With Forgetful, children learn about making a birthday cake while working on their language skills. Some programs allow children with severe disabilities to participate in simulated activities commonplace to preschoolers, such as building towers of blocks or blowing up balloons. To teach counting, Early Play entails stacking blocks and knocking them down. The software also allows the

child to decide whether to blow more air into a balloon or let it pop. As the student manipulates the virtual balloon, for instance, a teacher or aide performs the real-world action that the student selects.

Picture It is used to promote prereading skills. One teacher of a mainstreamed class writes stories with the children while using this software. They create the story together, and the teacher types the words. The words and their symbols appear on the screen. Another teacher develops students' prereading skills by having them draw pictures next to a word. She then bounds and laminates the pages, and the children take home a book they created.

Audiotape recorders and record players are used to teach language and motor skills. Augmentative communication devices such as Cheap Talk and Language Master also are used to help children develop language skills.

Overlays are used throughout the day both in conjunction with technologies, such as Intellikeys or Cheap Talk, or independent of technology by placing familiar symbols on a laminated sheet. The overlays, which usually are created with Boardmaker software, are seen as important for developing prereading skills. The children learn that a symbol represents a certain object or action. Overlays also serve as a means of alternative communication for nonverbal children and provides them with ways to make and communicate choices. The overlays enable all children to be active participants in their learning environments. All classrooms use software with the children, and the overlays on an Intellikeys keyboard allow children who do not yet read to use the software independently.

Summary

Dade County Public Schools' Prekindergarten Exceptional Student Education Program finds innovative uses for its funding resources. It makes technology readily available to children and teachers, and it provides extensive training and technical assistance. In this way, staff ensure that technology is used effectively. The PRIME Time Program has become critical to accurate and appropriate technology needs assessment, technical assistance, and classroom support. Teachers are given the encouragement and the tools to implement creative, innovative ideas that improve the quality of education received by the children in their classrooms. The program is effective because it has considerable financial resources and an extremely dedicated and knowledgeable technology team.

Supporting mainstreaming and skill development

Hearing impairments

Palm Springs Middle School, Hialeah, Florida

Palm Springs Middle School houses programs for students with hearing impairments, learning disabilities, and emotional disorders. This case study focuses on the program for hearing impaired students. Parents of many students who live outside the regular school zone elect to send their children to Palm Springs Middle School for one of its special education programs. In this way, there is a relatively high concentration of hearing impaired students, with 44 attending the middle school. Students have various levels of communication ability. The challenge to develop communication skills is further complicated for many students because Spanish is used at home and English is used at school.

The hearing impaired program promotes oral communication and use of American Sign Language. Two full time teachers, two paraprofessionals, and five interpreters staff the hearing impaired program. A speech pathologist visits the school 3 days per week. There also is a district technology coordinator who serves the middle schools.

The special education approach includes a strong commitment to mainstreaming students. The goal is to prepare students with skills needed to obtain a standard high school diploma after they leave this middle school. Staff expect students with disabilities to interact with other students as much as possible. In support of mainstreaming, during the first faculty meeting each year, staff receive an orientation to the hearing impaired program and explanations of the roles of interpreters, students, mainstream teachers, and special education teachers.

The hearing impaired program integrates participants into general education, and most students are mainstreamed first in math classes. In fact, the majority of students are mainstreamed in math, while only about three are mainstreamed for language. All students in the hearing impaired program eventually attend at least one mainstream class, but few attend only general education classes. Three students in the hearing impaired program are

completely mainstreamed. Two of these students have interpreters, and one uses only an FM system, which allows him to hear the teacher's voice clearly and reduces background noise.

Schoolwide technology

The entire school staff believes in technology solutions to educational objectives. The principal thinks that technology is important because it offers students a mode of learning that is more suited to their individual needs. He said,

> *Technology is another tool for them to reach the kids. . . . Some kids respond better to that type of learning than to the old lecture method that so many teachers relied on: a textbook, a blackboard, your voice, and that was it. Now you have so much more.*

The school's special education program uses technology as much as possible. As the team leader of the hearing impaired program said, "We use anything and everything that will help these kids get along, function appropriately, and become acclimated to anything in every program."

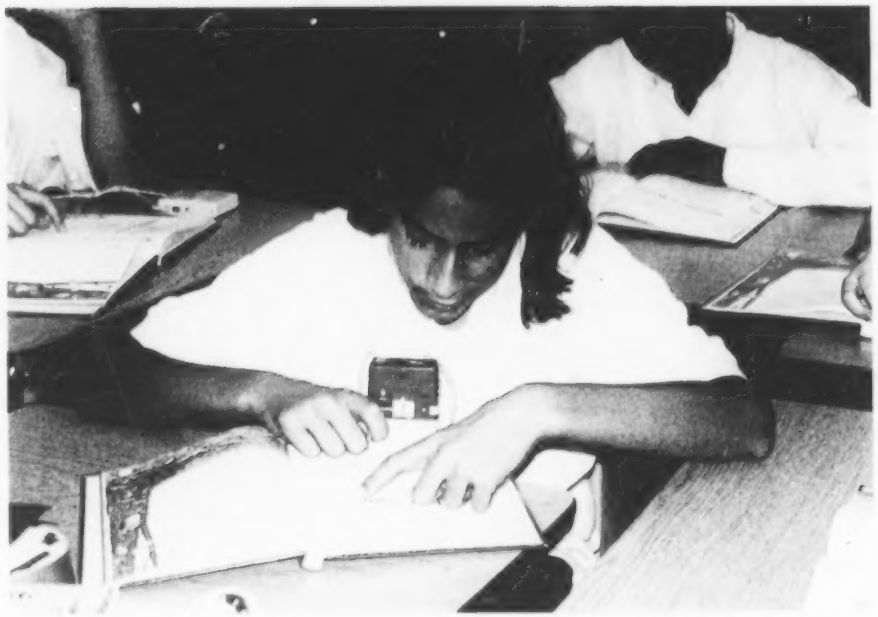
Palm Springs Middle School continually seeks to acquire instructional technology and equipment grants. With a large State grant, staff modified the school technology lab to include 11 stations. Each station focuses on a different topic, such as applied physics, biology, audio broadcasting, graphics, computer graphics and animation, and desktop publishing. Every station has a television with a built-in VCR and other equipment needed for that particular area. There is a flight simulator, audioediting equipment, a computer-assisted design machine, and many other impressive pieces of equipment not usually found in a middle school. Students learn to work with fiberglass, program traffic lights, build cars, and acquire numerous other vocational skills. When students master a station, they move to another one. Eventually students gain experience in all of the stations.

Students derive numerous benefits from participating in the technology lab. Several had their first introduction to computers through the lab. Many have acquired skills that resulted in summer jobs and permanent employment. Commenting on the lab's impact on students with special needs, the principal said:

> *Many of those kids have learning difficulties because they*

don't learn well auditorally. However, when they are given an opportunity to do hands-on work, they can excel. Maybe manually they are quite good, though their reading and auditory skills may be poor. They might not have the attention span to listen in a classroom. But when they are exposed to this technology and can get involved, these students get excited about what they are learning. They ask questions. They become more interested and involved. They love the independence of figuring out things and building things.

Experiencing success in the technology lab reportedly has improved self-esteem and transferred into gains in other areas. For some individuals, there have been fewer behavioral problems and their performance in many other academic areas has improved.



Technology use by hearing impaired students

The self-contained hearing impaired classroom functions as a resource room, with sixth through eighth graders taught in the same classroom. Numerous students use an FM system to permit them to hear spoken language. An FM system includes a receiving device worn by a hearing impaired individual and a transmitting device worn by another person. When both are tuned to the same channel, the receiver allows the user to more clearly hear spoken language. Students who use an FM system use it in both mainstream and hearing impaired classrooms. They pick up an FM unit in the morning in their homeroom and return it at the end of the school day. The FM systems are recharged overnight.

Several of the hearing impaired students are participating in a research project to evaluate the effectiveness of a tactile device worn around the waist. Depending on the tone and volume of speech, the device produces different vibrations that a trained user can interpret. The tactile aid often is used in conjunction with an FM system so that individuals can improve speaking ability both through auditory and tactual information. The team leader of the hearing impaired program noted that tactile devices greatly improve students' speaking ability. However, it has the disadvantage of being cumbersome to wear, and some students resist using it.

Students in the hearing impaired program also use captioned television. All classrooms have a television mounted on the wall. Captioned morning announcements are broadcast to all classrooms from a television studio in the library. Students can watch CNN for current events, and videotapes are shown after school 2 days per week. The team leader of the hearing impaired program believes that captioning is very effective with her students. In addition to providing access, captions help students acquire language skills such as spelling and reading.

Hearing impaired program staff continue to use older technologies that they find helpful. Film strips are used often because they are visual, simple, and meet the needs of lower-level students. The hearing impaired students enjoy the responsibility of running a filmstrip. They also like learning information through this medium.

Summary

Palm Springs Middle School's hearing impaired program is highly successful. It accomplishes its goal of helping students obtain a standard high school diploma by preparing them to function in a mainstream setting. Mainstreaming also helps the hearing impaired students feel that they are part of the school. Students enjoy participating in the program, as is reflected by their excellent attendance rates. The students are excited to come to school because the program offers them supports often not available at home.

The school has a philosophy of using both basic and advanced technologies to match students' different learning styles. Staff are encouraged to write grants to acquire state-of-the-art technology, and much equipment has been acquired in this way. Students and staff continue to benefit, however, from older technology. Finally, this program illustrates that special education teachers, mainstream teachers, and building administrators meet their students' needs best when they work together.

79

Building communication and independent living skills

Autism

Oakland County Intermediate Unit, Madison Heights, Michigan

The autism program run by the Intermediate Unit of Oakland County Schools helps students achieve their maximum academic potential and greatest level of independence. Serving approximately 300 students countywide, program staff foster the development of communication and independent living skills. Staff work with secondary and postsecondary students to develop successful job experiences and to facilitate smooth transitions from school to the adult world.

The autism program uses an approach that provides students with an organized physical environment, a predictable daily schedule, and individualized educational programs. Teaching methods include systematic use of directions, prompts, and reinforcers. Instruction includes academic knowledge, social development and play skills, personal growth and development, daily living and community life, fine and gross motor development, and sensory integration. Students may receive additional services such as art, music, occupational, physical, and speech/language therapies. Students and families also are supported through social work services and a parent training program that includes open houses, guest speakers, and a support group for parents of younger, recently identified children.

People with autism typically are more responsive to visual cues than auditory ones. Many have deficiencies in verbal and nonverbal communication, social interactions, and leisure or play activities. They have difficulty communicating and relating to the world. While students with other communication disorders may be unable to produce or receive language at an age-appropriate level, some children with autism typically do not initiate communication in any form, including eye contact and hand gestures.

Developing communication skills

Oakland County teachers write and prominently post signs with information that they want students to retain. These signs include

class rules, schedules, and task lists. Whenever possible, drawings or photographs accompany words. The combination of written language, drawings, and photos helps students develop verbal abilities. Speech/language therapists often work with parents to develop signs and cards for communication. For example, one mother knew that her son's favorite fast foods were chicken and a soft drink. The therapist made a laminated card for the student to use when ordering these items at fast food restaurants. Series of picture cards are also useful in the vocational program. Older students use a series of pictures to guide them in carrying out training tasks such as filling order bags with specific items. With the visual cue of cards, they can see how much is needed, what to do next, and when the task is completed.

One of the approaches that staff have found to be most successful is community-based education. Students go into a community setting such as a barber shop, grocery store, or fast food restaurant. There they can practice basic communication and independent living skills in natural settings. Before going to the site, they work on related functional academic skills such as reading a menu, figuring out the cost of lunch, and counting money. Once there, they use their communication skills by placing orders and talking to classmates at the table. These outings also provide an opportunity for students to make choices and to experience some independence.

Augmentative communication devices offer many children a means to express thoughts and ideas, increase vocabulary, and solve problems. The instructional team works together to match children with the most appropriate device. Some preschoolers with autism are provided with augmentative communication devices so that they can communicate simple needs and wants. Older students can use the devices to express increasingly more complex ideas. One child in a preprimary diagnostic prescriptive program is learning to use a device that has four levels of complexity. He is able to change the device's difficulty level in order for it to say his favorite words, his current favorite being "tickle." As he continues to use the machine, his teachers expect the number and complexity of ideas he generates to rise rapidly.

Student computer use

Students in the autism program use computers in three primary ways. They use them for academic skill tutoring and remedial help, word processing and composition, and interactive multimedia to develop academic and communication skills.

Higher functioning students derive many benefits from the use of computers. At one school, a mainstreamed student uses computers in a lab with his classmates several mornings per week. The lab, which is designed to provide self-paced instruction, easily

accommodates the 2-year range in reading level among the students in the class. This system allows the student to work alongside his classmates much of the day. In the afternoon, he works with a special education teacher. While the morning activities help the student acquire general academic skills, the afternoon tutoring focuses specifically on improving his writing skills.

Students with very low academic skills also benefit from computer use. One teacher recounted her experiences working with a young adult who wanted to learn keyboarding. Although the student had limited vocabulary and reading skills, she was so motivated that she would work continually for a very long time to improve her skills. Multimedia technology is a valuable tool because most programs are highly visual. Preschool children and older students with severe autism use developmentally appropriate CD-ROM applications such as those that allow instant coloring of pictures via a mouse click. Other students learn from a full range of resource compact disks.

Computers have benefits for students with autism beyond letting them work at their own level and pace. Students also are afforded a break from interacting with people while working on the computer. This break can remove some of the stress students experience in the classroom. In addition, some students experience frustration when trying to write by hand. "If you type on a computer, you get the same thing every time you do it," said one teacher. "The student doesn't have to worry about being perfect. If you make an *a* by hand, it isn't always going to look the same. But when you make an *a* on the computer, it is always going to look like an *a*."

Audio and video applications

Using multisensory instructional approaches, staff are always striving to improve students' ability to process auditory input. In a self-contained cross-age elementary school class, for example, students listen to stories on tape while simultaneously looking at laminated pictures and words. The instructional staff create the stories specifically for the students. The story lines are meaningful and interesting to the students and include people and settings they know. Listening to audiotapes allows students to make choices and learn independently. They can choose a tape, insert and start the tape without assistance, and listen to the story. On days when a student chooses to isolate himself, tapes can be a particularly valuable tool. As one teacher said, "Sometimes if he's having a bad day, he'll listen to the tape rather than have me come help him. But he's still learning, so it's okay."

Staff make videos with students that focus on improving communication and independent living skills. Staff have made videos that teach vacuuming, grocery shopping, and initiating

conversation. Teachers find that videos allow repetition with a highly visual instructional medium. As one teacher said, "Students can watch it over and over again. I had a social skills class where students were learning to initiate a conversation. We videotaped it and we went through all the steps. After watching the videotape, they really got what we were doing. The more visual you make it, the better off you are."

Program staff take an interdisciplinary approach to developing videos. Students are engaged in many academic and artistic activities in preparation for video production. Most of the videos include music performed by the students themselves. One teacher, for example, collaborated with a music therapist and an art therapist to produce a video about a visit to a fast food restaurant. The music therapist wrote a song about some of the things that take place in a restaurant. The art therapist helped students create the huge three-dimensional hamburger and the gigantic bag of french fries featured in the video. Students formed a five-piece band, practiced, and were videotaped playing at the restaurant. As one teacher described the experience,

> *The students were treated to a variety of auditory, tactile, and visual stimuli. The sound of the music, along with the vibration and opportunity to view all of the instrumentalists "firsthand," heightened the experience and motivated students to organize themselves. The videotaping provided a beautiful experience for students to relate to one another. The students were excited to see themselves on television, and sense of pride and accomplishment could be seen on their faces.*

Students and teachers created a music video entitled "The Barber Jive" for a student who was afraid of getting his hair cut. A teacher for a middle school class created a fitness video to help her students learn to exercise. Program staff also developed a video to teach a young child how to follow a routine of basic activities such as brushing her teeth, eating breakfast, and leaving for school.

Sometimes technology provides unexpected ways to integrate higher functioning students into the mainstream. One high school student decided to take a broadcasting course. It is a relatively fast-paced course in which students have 40 minutes to conduct interviews, write weather and news reports, and deliver the material during school announcements. As a teacher said, "Although the characteristics of autism would predict that the student would dislike such a program, the student loves the program and hopes to go into journalism." A supportive teacher understood his need to have structure within this relatively unstructured environment. The teacher assigned one job, cameraman, to this student. The student became very skilled with the equipment, and other students seek his assistance when they need to use the camera.

Summary

Autism is a complex disorder that challenges the creativity of the educators who provide services to these students and families. Teachers and therapists in the Oakland autism program use technology to stimulate interest in learning, to help students communicate more effectively, and to enable students to acquire new academic and independent living skills. Technologies used include augmentative communication devices, computers, videos, and audiotapes. Staff are convinced that use of these technologies is an important part of their program. They expect to continue and even expand their use of technology in coming years.

Resource list

AlphaSmart. Intelligent Peripheral Devices, Inc. 20380 Town Center Lane Suite 270, Cupertino, CA 95014. (408) 252-9400 Fax:(408) 252-9409.

Alpha Talk. Prentke Romich. 1022 Heyl Road, Wooster, OH 44691. (800) 262-1984.

Apple Computers. Apple Computers Inc. 20525 Mariani Ave., MS33G Cupertino, CA 95014. (800) 282-2732.

Boardmaker. Mayer Johnson Co. PO Box 1579, Solana Beach, CA 92075-1579. (619) 550-0084 Fax: (619) 550-0049.

Braille'nSpeak. Blazie Engineering. 105 East Jarrettsville Road, Forest Hill, MD 21050. (410) 893-9333 Fax: (410) 836-5040.

Carmen San Diego. Edmark Corporation. PO Box 97021, Redmond, WA 98073-9721 (800) 362-2890.

Cheap Talk. Toys For Special Children. 385 Warburton Ave., Hastings-On-Hudson, NY 10706. (800) TEC-TOYS.

Claris Works. Subsidiary of Apple Computers Inc. (800) 3-CLARIS.

Closeview. Apple Computer Inc. and Worldwide Disability Solutions Group, MS 38DS, One Indefinite Loop, Cupertino, CA 95014 (800) 600-7808. (800) 755-0601 TTY.

Co-Writer. Don Johnston, Inc. PO Box 639, Wauconda, IL 60084-0639. Fax: (847) 526-4177.

Dirty Duds. Storytime Tales. Don Johnston Inc. PO Box 639, 1000 North Rand Road, Bldg 115, Wauconda, IL 60084-0639. (800) 999-4660.

Dyna Vox. Sentient Systems Technology, Inc. 2100 Wharton Street, Suite 630, Pittsburgh, PA 15203. 412-381-4883 800-344-1778.

Early Play. Linda J. Burkhart. 6201 Candle Ct. Eldersburg, MD 21784. (410) 795-8835.

Forgetful. Storytime Tales. Don Johnston Inc. PO Box 639, 1000 North Rand Road, Bldg 115, Wauconda, IL. 60084-0639 (800) 999-4660.

The Great Ocean Rescue. Tom Snyder Productions, Inc. 80 Coolidge Hill Road, Watertown, MA 02172. (800) 342-0236.

The Great Solar System Rescue. Tom Snyder Productions, Inc. 80 Coolidge Hill Road Watertown, MA 02172. (800) 342-0236.

Groliers Multimedia Encyclopedia. Grolier Publishing. 90 Old Sherman Turnpike, Danbury, CT 06816. (800) 621-1115.

HyperCard. Subsidiary of Apple Computer Inc. (800) 795-1000.

HyperStudio. Roger Wagner Publishing, Inc. 1050 Pioneer Way, Suite P El Cajon, CA 92020. Fax:(619) 442-0525.

Intellikeys. IntelliTools, Inc. 55 Leveroni Court, Suite 9, Novato, CA 94949. (800) 899-6687.

Language Master. Franklin Electronic Publishers. One Franklin Plaza, Burlington, NJ 08016. (800) 525-9673.

Mavis Beacon. Comspec Communications, Inc. Toronto, Canada. (416) 785-3553 Fax: (416)785-3668.

Oregon Trail. The Learning Company. (617) 761-3000.

PageMaker. Fliptrack Learning Systems. 2055 W. Army Trail Road #100, Addison, IL 60101-1478. (800) 222-3547.

Picture It. Slater Software. 351 Badger Lane, Guffey, CO 80820. (719) 479-2255 Fax:(719) 479-2254.

PowerPoint. Microsoft. One Microsoft Way, Redmond, WA 98052-6399.

Printshop. Atlas Software BV. Buys Ballotstraat 17-19, 3846 BG Harderwijk, The Netherlands. +31(0)341-426700 Fax:+31(0)341-424608.

Touch Windows. Edmark Corporation. Attn: Customer Service, PO Box 97021, Redmond, WA 98073-9721. (800) 691-2986.

UltraKey. Bytes of Learning, Inc. 60 Renfrew Drive, Suite 210, Markham, ON L3R 0E1, Canada. (800) 465-6428.

Write: Out Loud. Don Johnston Inc. PO Box 639, 1000 North Rand Road, Bldg 115, Wauconda, IL. 60084-0639 (800) 999-4660.

Photo descriptions

Page	Subject
Cover	Student receives speech/language instruction in Dade County, FL.
1	By using a closed circuit television, low-vision student in Nashville, TN, can see what he is writing.
2	Boardmaker overlays show the steps in making a snack in Dade County, FL.
3	By pressing buttons on Intellikeys keyboard, student in Dade County, FL, learns about cause and effect and makes choices.
4	In Nashville, TN, teacher and student use a Dyna Vox.
6	Teacher and student in Madison County, MI, use educational software.
7	General and special education students work together.
8	Students use laptops and desktop computers to complete an assignment, while others works on it by hand.
9	Student does an assignment using an AlphaSmart keyboard.
11	Two students work together to research a historical figure. They use multimedia and print materials.
13	Student researches on the Web and looks up words in the dictionary.
14	Individual uses a standard keyboard.
15	With a teacher's assistance, student creates a personal home page.
17	Student transfers work from AlphaSmart keyboard.
18	Aide instructs student in using a printer.
21	General education peer tutor communicates with a special education student using Boardmaker-created cards.
23	With closed circuit television, student reads a book.
25	Braille'nSpeak provides an alternative means of writing.
26	Low vision aid increases access to information.
27	Student uses audio and other technologies.
29	Cheap Talk teaches child about cause and effect and making choices.
30	Student uses a touch screen and an Intellikeys keyboard.
32	Student experiences multisensory leaning with the software, Dirty Duds.
33	Teacher and student discuss educational print materials.
34	Student uses a flight simulator in the technology lab.
35	The FM system allows this individual to hear what the teacher says.
37	Educational game teaches letter recognition.
38	Student uses a speech synthesizer for multisensory learning.
39	Student uses audiotape individually to learn subject matter.

Endnotes

1 National Center for Educational Statistics. 1997. Findings from education and the economy: An indicators report. Washington, DC: GPO.

2 National Center for Educational Statistics. 1992. 1992 National adult literacy survey. Washington, DC: GPO.

3 National Education Goals Panel. 1995. The National education goals report. Washington, DC: GPO.

4 Brett, Armond. nd. *Alternative education for at-risk students.* Unpublished manuscript.

5 Dade County Public Schools. 1996. *Prekindergarten: The right beginning!!* Miami, FL: Dade County Public Schools, Office of Exceptional Student Education, Prekindergarten Program for Children with Disabilities.

6 Dade County Public Schools. 1996. *Teacher's Handbook: Programs for prekindergarten children with disabilities.* Miami, FL: Dade County Public Schools, Office of Exceptional Student Education, Prekindergarten Program for Children with Disabilities.

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